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Synthetic Turfgrass and the Nine Principles of Florida-Friendly Landscaping™[1]

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Introduction

Homeowners in Florida are offered many different species and cultivars of natural turfgrass to consider for their lawns, each offering varying levels of shade, maintenance, water, disease, and pest resistance, as well as differences in color, texture, and overall aesthetics. Recent additions to the list of available turfgrasses have benefited from extensive breeding programs to develop cultivars that need fewer inputs (e.g., water and fertilizer), have fewer pest problems, and require less mowing, all traits that contribute to their appropriate use in Florida-Friendly Landscaping™ (FFL) (Momol et al. 2021).

However, in addition to these living turf options, some homeowners replace natural turfgrass with synthetic turf, also referred to as artificial turf. Originally developed as a durable, low-maintenance playground surface, synthetic turf is a manufactured product that utilizes synthetic fibers that mimic the aesthetic look of natural grass. Essentially outdoor carpet, artificial turf is typically composed of nylon, polypropylene, or polyethylene fibers connected to a reinforced backing material. While designed to imitate the look of natural turf, synthetic turf does not provide the ecosystem benefits of a natural turf system. This publication examines the properties of synthetic turf in relation to each of FFL's nine principles.

Florida-Friendly Landscaping™: The Nine Program Principles

FFL protects Florida's natural resources by conserving water, reducing waste and pollution, creating wildlife habitat, and preventing runoff and erosion (Momol et al. 2021). Landscapes in Florida can be Florida-Friendly if designed and maintained according to the nine Florida-Friendly Landscaping™ principles (FYN Handbook 2015). Each of the nine Florida-Friendly Landscaping™ principles are evaluated below as they relate to living turfgrass and its potential replacement by synthetic turf.

1. **Right Plant, Right Place**: FFL's mission is to provide science-based information for creating resilient, sustainable landscapes of living plants that have been specifically selected and appropriately installed so that they require little or no irrigation, fertilizer, or pesticide. Because synthetic turf is not alive, it does not meet the criteria

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of a plant choice for an FFL landscape. As a living plant, natural turfgrass plays an important role in cooling the environment that synthetic turf cannot. Average surface temperatures of a natural turfgrass lawn have been reported to be as much as 70°F cooler than a dormant brown lawn and as much as 100°F cooler than synthetic turf surfaces. Higher surface temperatures increase the surrounding air temperatures and result in an increase in the energy required for mechanical cooling of adjacent homes and buildings. Caludio (2008) describes heat island effects generated by larger installations of synthetic turf. Living turfgrass also provides a root zone, which helps to filter and slow runoff and stop erosion. Synthetic turf cannot do this, because part of its installation requires compacting the earth below, increasing runoff beneath the synthetic turf.

2. **Water Efficiently**: Synthetic turf systems do not require supplemental irrigation; however, installations may require water use for different reasons. As mentioned above, synthetic turf can become excessively hot, with one author (Kruse) measuring surface temperatures on synthetic turf as high as 160°F. Because of these high temperatures, it is common for users to spray the surface with water to cool it for use, which may negate some of the perceived benefit from the system not requiring "irrigation." In addition, many manufacturers recommend weekly wash downs of the artificial turf surface to remove contaminants such as dust and pet waste and its odor. These washings, especially those to remove pet urine, often use quite a bit of water because the waste must pass through the artificial turf, the underlying substrate, and the weed barrier before being carried away. This wash water will generally not infiltrate into the ground below because of soil compaction conducted before installation of the synthetic turf. As noted in *The Ultimate Artificial Grass Maintenance Guide* (neograss.co.uk):

   > If your lawn has not been installed on a free-draining sub-base, then you may need to purchase one of the many artificial grass cleaning products available on the market that will remove the smell of urine and sanitize your lawn.

   Living turf, on the other hand, helps cool the environment, absorbs pet urine, and does not require washing to remove odors or dust. Once established, living turf needs minimal water during times of drought.

3. **Fertilize Appropriately**: Synthetic turf systems do not require fertilization. However, the lack of a root system and its associated microbial community in synthetic turf systems eliminates the water filtration benefit that is gained through the installation of a living turfgrass system.

4. **Mulch:** In an FFL landscape, mulch is often incorporated within ornamental beds and around shrubs to maintain soil moisture and control weed growth. However, mulch application is not applicable to synthetic turf systems.

5. **Attract Wildlife:** An FFL landscape will often incorporate elements that attract wildlife, including the installation of host and pollinator plants to attract butterflies and native bees, as well as mixes of shrubs and trees that provide food, cover, and nesting opportunities for birds and other wildlife. This effect is amplified when natural wildlife preserves, and other green areas are adjacent or nearby. Research has shown that turfgrass lawns support an abundance of beneficial arthropods, such as beetles, bees and wasps, as well as worms, which in turn support larger wildlife such as birds and other ground-feeding wildlife (Shimat et al. 2020). Synthetic turf does not offer any benefits that attract or support wildlife.

6. **Manage Yard Pests Responsibly:** A fundamental component of FFL is using the appropriate combinations of plants (see FFL Principle No. 1: Right Plant, Right Place) maintained through proper irrigation and fertilizer protocols, so that yard pests are controlled with little or even no need for pesticide application. This holistic pest management approach forms the basis of integrated pest management, or IPM. As discussed above, while synthetic turf plays no role in attracting or supporting wildlife, it also does not contribute to the mix and balance of landscaping plants that promote IPM.

7. **Recycle Yard Waste:** FFL promotes the recycling of yard and landscape clippings into mulch and compost. This not only reduces the amount of yard waste that must be picked up curbside and transported for disposal, but yard waste converted to compost and used as fertilizer decreases the need for a homeowner to buy other fertilizers, especially synthetic fertilizers. Because synthetic turf is primarily plastic, it does not directly generate yard waste such as leaf litter and clippings, although falling leaves that accumulate on the synthetic turf must still be removed to prevent wear and tear. More importantly, however, synthetic turf has a finite life span, perhaps 10 to 20 years depending on the quality of ongoing care including rinsing, removing leaves, and sanitizing. At the end of its life, the synthetic turf will need to be removed and replaced, with the ultimate disposal of the old synthetic turf most likely in a landfill.

8. **Reduce Stormwater Runoff:** The primary base construction for synthetic turf systems in residential landscapes involves removal of a portion (2"–3") of the topsoil followed by heavy compaction of the remaining soil to establish a firm, uniform base on which to install the synthetic turf product. This compaction reduces soil infiltration rates and increases the risk of runoff from the landscape. While it may be possible to use rain gardens, berms, and swales to retain runoff on the property, there remains a significant risk of increased runoff when compared to natural turfgrass, which has been shown to increase soil infiltration rates. A recent study by Simpson and Francis (2021) demonstrated that synthetic turf lawns had more runoff and decreased water retention compared to living turf lawns. A similar study (Chang et al. 2021) found that living turf provided greater runoff control than synthetic turf.

    a. In addition to runoff volume, synthetic turf runoff has been shown to contain zinc in concentrations that pose a potential risk to surface waters and aquatic organisms (Connecticut Department of Environmental Protection 2010). Another synthetic turf study in New York found that runoff water from rain or from spraying or misting contained some 25 different chemical species and four metals (zinc, selenium, lead, and cadmium) that were released into water from the rubber infill incorporated into the synthetic turf (Claudio 2008).

    b. In contrast to synthetic turf, a healthy, established natural turf system consists not only of the dense cover of the aboveground grass blades, but also an underlying deep, intricately intertwined root zone that can filter and absorb contaminants. Natural turf installations improve soil structure over time and as a result enhance water filtration and infiltration into the soil. A robust root zone with healthy soil will also absorb dissolved nutrients, decrease nutrient leaching into the underlying ground water, and sequester carbon. Because, by definition, synthetic turf systems do not consist of plant material, they have no capacity to provide these same ecosystem services as a living turf.

9. **Protect the Waterfront**: Synthetic turf systems lack the soil-stabilizing benefits offered by the rootzones of flood-tolerant plants that are typically found along the edges of water bodies. The presence of these plants protects the shoreline from erosion and has been documented as having a significant impact in reducing the concentration and amount of contaminates that enter bodies of water through stormwater runoff. Installation of a synthetic turf system along the edge of a water body increases the risk of soil erosion due to the lack of an established soil-stabilizing rootzone. In addition, the increased risk of runoff due to compaction of the soils during installation will increase the risk of pollutants reaching the water body that may have otherwise been caught/filtered out by the natural turfgrass system.

Conclusions

Protecting and preserving Florida's water resources through sustainable landscaping practices on living landscapes is the primary focus of the Florida-Friendly Landscaping™Program. It strives to achieve this goal through implementation of nine principles designed to reduce the environmental impact of urban landscapes while creating wildlife habitat, preventing erosion, and reducing landscape-based contributions to landfills. When considering the use of a synthetic turf system in the urban landscape, it is important to understand all the potential environmental impacts. Synthetic turf systems have not been shown to improve or create wildlife habitat, do not improve groundwater recharge, can heat excessively in the sun and, in more extensive installations, can cause a substantial heat island effect. In addition, synthetic turf generates higher stormwater runoff than natural turf and has been shown to leach a variety of contaminants, including both organic compounds and heavy metals. Finally, since synthetic turf is primarily plastic it has a finite lifespan and must eventually be disposed of in a landfill, a practice that is counter to the sustainability goals of the Florida-Friendly Landscaping™ Program.

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